

Version With Markings to Show Changes Made



On page 2, please amend the following paragraph starting on line 3 and ending on line 7:

Another aspect of the invention involves using a shadow mask during the deposition process. The shadow mask may be integrated into the display panel, or may be removable and, optionally, reusable. The integrated mask may comprise photoresist, including dry film photoresist. The removable mask may be made from crystalline material[,] (such as silicon), metal, or polymer.

On page 8, please amend the following paragraph starting on line 8 and ending on line 19.

A removable mask comprises a series of slots that are defined by ribs. Materials comprising pixels are deposited through the slots. Materials suitable for making a removable mask include crystalline materials such as silicon, metal materials such as copper and steel, and polymeric materials. A removable mask is typically made by removing material where the slots will be located, while leaving [in tact]intact the material that forms the ribs. A removable mask may be made by a variety of techniques, including conventional machining; micromachining; diamond machining; laser ablation; or chemical, plasma, or ion beam etching (typically patterned by photolithography). Electric discharge machining (EDM), also called electrodischarge or spark-erosion machining, is a well-known technique that can be used for making a mask. EDM works by eroding material in the path of electrical discharges that form an arc between an electrode tool (in this case a wire) and the work piece.

On page 9, please amend the following paragraph starting on line 8 and ending on line 19.

As illustrated by Figure 4, an aspect of the present invention corrects parallax error by providing precise alignment of the angled dopant sources being deposited through ribs **64** with subpixel electrodes **70** patterned on the substrate by making pixel pitch **66** slightly larger than rib pitch **68** on the mask according to the following formula:

$$p' = p(1+h/d)$$

where p' is the pitch of the pixels (corresponding to the pitch of the electrodes).

p is the pitch of the ribs of the shadow mask,
d is the height of the substrate above the source, and
h is the height (i.e., thickness) of the shadow mask.

On page 10, please amend the following paragraphs starting on line 5 and ending on line 32:

A removable and reusable metal shadow mask was fabricated from a steel plate (0.047" (1.194 mm) thick) using wire electric discharge machining (Wire EDM). Slots machined into the steel plate measured 0.065" (1.651 mm) wide and 0.0746" (1.895 mm) center-to-center (i.e., pitch), leaving ribs having a width of 0.0096" [(24.4 μ m)] (0.244 mm) (with a pitch of 0.0746" (1.895 mm), and a height of 0.047" (1.194 mm)). The small difference in pitch between the metal mask (0.0746" (1.895 mm)) and the ITO columns (0.075" (1.895 mm)) were appropriate to compensate for parallax in an evaporator system in which the substrate was positioned about 9" (229 mm) above the sources.

The substrate with etched ITO lines was coated with a spun-on conductive polymer buffer layer of polyethylenedioxythiophene such as Baytron P available from Bayer (Pittsburgh, PA) and dried on a hot plate (100°C) in a nitrogen atmosphere. The substrate was then placed on the metal mask and the ITO columns were aligned with the slots in the mask. The mask and substrate were clamped together and positioned in the vacuum evaporator system, which was evacuated to approximately 10^{-6} torr (1.3×10^{-4} Pa). A hole transporting layer (HTL) was first applied [(NPD)] (NPB) with an approximate thickness of 30 nm. Then an electron transporting layer (ETL) was applied (BAIq) which also acted as a host for the dopants. Approximately 20 nm of the ETL nearest the HTL was doped, followed by approximately 20 nm of undoped ETL. The dopants used were perylene (blue), C545T (green) and PtOEP (red). The HTL, ETL, and blue dopant sources were arranged at the bottom of the evaporator chamber, in a line directly beneath and parallel to the ITO columns. The red and green dopant sources were placed some distance from that line, so that the evaporant beams from those dopant sources impinged the substrate at an angle of about 40° from normal. Ribs of the mask cast a shadow such that the green and red dopants impinged only on the appropriate ITO subpixel columns, and not on the subpixel columns for the other colors. The blue dopant was deposited on all three subpixels, but in the green and red subpixels, the green and red dopants effectively dominated the emission spectrum so that any blue emission from those subpixels was inconsequential.